

Developing the Concept of Sexual and Reproductive Health in Women with Type-1 Diabetes Mellitus: A Directed Content Analysis

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ARTICLE INFO	ABSTRACT
Article type: Original article	Background & aim: Research has demonstrated the negative effects of type-1 diabetes mellitus (T1DM) on the female sexual health and reproductive function. The present study was conducted to develop the concept of sexual and reproductive health (SRH) in women with T1DM.
Article History: Received: 20-Jan-2022 Accepted: 14-May-2022	Methods: This concept development was conducted by directed content analysis of relevant literature. A search was carried out for articles published from 2000 to 2019 in English databases including PubMed, Web of Science, Scopus, Embase and Persian databases including Magiran, SID, and IranDoc and search engine such as Google Scholar based on a search strategy developed for each database using Boolean operators. The initial matrix was designed based on the framework proposed by the United Nations Population Fund (UNFPA) and the World Health Organization (WHO) and information resources related to them for the concept of women's sexual and reproductive health (SRH). The selected articles were analyzed using directed content analysis with deductive approach proposed by Hsieh and Shannon.
Key words: Sexual and Reproductive Health Type 1 Diabetes Mellitus Women	Results: The final codes were extracted from the review of 151 articles based on their conceptual differences and similarities, and categories were then defined and a matrix was developed. Four categories were extracted in this study for the concept of SRH in women with T1DM, including reproductive system, safe motherhood, sexual and gender-based violence, and sexual function, along with 20 subcategories.
	Conclusion: The findings can be utilized to develop specific tools for assessing SRH in women with T1DM as well as designing programs targeting SRH promotion in this vulnerable group.

►Please cite this paper as:

Azimi N, Ozgoli G, Ebadi A, Alavi Majd H, Rajab A, Kiani Z. Developing the Concept of Sexual and Reproductive Health in Women with Type-1 Diabetes Mellitus: A Directed Content Analysis. Journal of Midwifery and Reproductive Health. 2022; 10(3): 3337-3354. DOI: 10.22038/jmrh.2022.63127.1806

Introduction

Type 1 diabetes mellitus (T1DM) is a complex metabolic disorder characterized by the

development of chronic hyperglycemia as a result of defective insulin secretion following

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the destruction of pancreatic beta cells by the immune system (1). According to the latest statistics of the International Diabetes Federation in 2019, 463 million adults aged 20-79 in the world had diabetes, which is equivalent to 9.6% of this population group in Iran (2). Around 10% of people with diabetes mellitus have T1DM and this disorder affects people of different ages (3). Currently, more than 1.1 million people younger than twenty years suffer from T1DM. In Iran, the prevalence of T1DM is 7.8 cases per 1000 of the population younger than twenty years old (4).

Studies have shown the negative impact of T1DM on the dimensions of sexual and reproductive health (SRH). Chronic hyperglycemia plays a negative effect on the function of the reproductive system by damaging the vessel walls and the autonomic nervous system (5). Sexual function is also affected by changes in blood flow, increased incidence of vaginal infections, decreased vaginal wetness and long-term complications such as neuropathy (6). Hormonal disorders caused by hyperglycemia affect fertility and cause complications in the internal genital system as well as menstrual disorders, late menarche, premature menopause and infertility (7).

Pregnant women with T1DM are more susceptible to high blood pressure (BP), being overweight, inability to control their blood sugar (BS), preeclampsia, cesarean section (CS), and infections, and their infants are prone to congenital anomalies, preterm birth, macrosomia, early neonatal death, labor dystocia and brachial plexus injury (8). Various studies have examined the dimensions of SRH in women with T1DM, including some of the constructive aspects related to the concept of SRH. Meanwhile, the concepts of SRH can be broader than those mentioned in the classification of the WHO and UNFPA due to the nature and consequences of the disease.

Studies in the domain of SRH in women with T1DM have been designed based on general definitions of this concept and their assessment tools integrate all aspects of reproductive and sexual health for this group as dedicated do not cover and are often consistent with the routine care associated with diabetes. The current

status assessment tools also do not cover all aspects of reproductive and sexual health specifically for this group and are often consistent with the routine care associated with diabetes.

It is therefore necessary to draw comprehensive conclusions to develop the concept of SRH in women with T1DM. The present study was designed using directed content analysis to outline, develop, complete, and conclude the concept and dimensions of SRH in this group of women.

Materials and Methods

The present study was designed based on directed content analysis of relevant literature with deductive approach. To develop a concept based on a research question, different methods including content analysis based on theoretical frameworks, review of literature and comparative study, concept analysis, grounded theory, Q-methodology and phenomenology are used (9). When consistent theories are present about a concept or phenomenon, the researchers could rely on the theoretical and practical definitions derived from the theory and produce appropriate items. Researchers can design or redesign a conceptual framework by combining existing theories about a phenomenon (10, 11).

The domain of the concept of SRH in the existing texts and knowledge is extensive. Therefore, to categorize and summarize this extensive domain and review of literature, the authors of this article (SRH and Diabetes Specialist) reviewed, modified, and categorized the SRH domain of women derived from WHO, UNFPA (12, 13), and information resources to these two organizations (14-20). The result of this categorization was six general dimensions as follows: safe motherhood, family planning, STD, HIV/AIDS, sexual history, and sexual and GBV.

After determining the modified domains of women's SRH (12-19), directed content analysis was performed with a deductive approach using selected literature.

In order to access all the texts that evaluated the concepts related to SRH in women with T1DM, review of literature was performed. Medical Subject Heading (MeSH) terms were prepared based on the modified domains of

women's SRH and all the main words and their synonyms were entered as search queries in the selected databases according to the MeSH term. The keywords searched in the selected English

and Persian databases included diabetes mellitus and the grouping of words presented in Tables 1.

Table 1. Keywords* used for search based on the Mesh terms and classification of WHO and UNFPA databases

Safe motherhood	Family planning	HIV, AIDS	Sexually transmitted diseases	Sexual function	Sexual and gender-based violence
Fertility	Contraceptive agents			Sex counseling	
Reproduction	Family planning services			Sex education	
Reproductive medicine	Family planning education			Sexual health	
Reproductive health	Contraceptive agent's female			Sexual behavior	
Pregnancy outcomes	Contraceptives oral, hormonal	HIV AIDS	Sexually transmitted diseases	Sexual dysfunctions	Sexual and gender-based violence
Maternal outcomes	Condoms, female			Sexual dysfunctions	Violence
Neonatal outcomes	Contraceptive effectiveness			psychological	
Prenatal measures	Family planning			Quality of marital life	
Maternal welfare	Contraceptive pills			Sexual function	
Pregnancy outcome	Uterine devices			Sexual counseling	
				Sexual function questionnaire	

*The words psychometrics surveys, questionnaires, and diabetes mellitus were used in combination with the keywords in the search strategy according to Table

In the next step, searching were carried out in English databases including PubMed, Web of Science, Scopus, Embase, and Persian databases including Magiran, SID, and Irandoc and search engine of Google Scholar for the time period from 2000 to 2019. The search strategy suggested for each database was applied to create the search queries, and the Boolean operators "AND" and "OR" were used.

In each database, the appropriate items for limiting the search and making it more specific, such as reproductive age, female sex, year, and Persian and English languages, were selected in accordance with the filters in that database for all types of studies.

The articles on the chronic complications of diabetes for the vital organs, those examining the male sex or patients with type 2 diabetes and gestational diabetes, those comparing drug administration methods and assessing laboratory indexes, those conducted on age groups outside the reproductive age range, those with epidemiological data on the disease process and in general the articles not having as

objective the dimensions of SRH in women with T1DM and articles that could not be accessed in full were excluded.

The texts selected from literature were analyzed by directed content analysis with Hsieh and Shannon method (21) based on the modified domains of women's SRH (12-19).

Directed content analysis aims to validate or develop a theoretical framework or theory, and data coding starts using a theory or the findings of former relevant studies and aims to validate or develop a theoretical framework or theory (22). In some cases, when there is an incomplete theory about a phenomenon, directed content analysis is used to further develop it (21). Models or theories used in directed content analysis help examine a structured process of analysis and identify the primary categories (23).

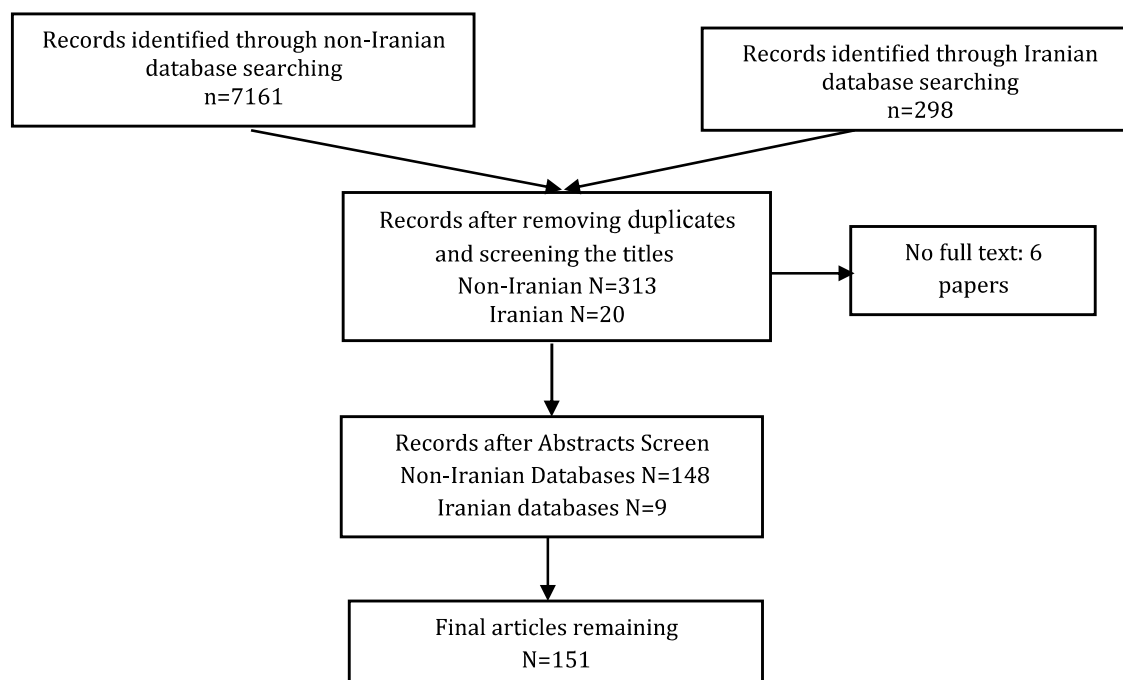
Results

The full text of 151 selected articles was analyzed in this study. These articles were reviewed to extract the codes. Duplicate codes

were removed and the remaining codes were categorized based on their thematic similarities based on the modified domains of women's SRH. The assessing of articles (article search, analysis and expression of findings) was performed under the supervision and guidance of the research team.

Figure 1 shows the flowchart for retrieving and selecting articles related to the research objectives to develop the concept and determine the categories and subcategories of SRH in T1DM (Figure 1).

Figure 1. Flowchart for accessing and selecting related articles



According to the findings, the concept of SRH in women with T1DM consists of four categories safe motherhood, reproductive system, sexual and gender-based violence, and sexual function and 20 subcategories : Measures and considerations before pregnancy, measures and considerations during pregnancy, maternal outcomes in pregnancy ,fetal outcomes ,problems, measures and considerations during labor, problems, measures and considerations during delivery ,problems, measures and considerations in postpartum period ,neonatal outcomes ,family planning and side effects ,genital infection ,puberty ,menstrual cycle effects ,ovarian function ,infertility ,menopause ,sexual violence ,verbal violence ,non-verbal violence ,sexual satisfaction ,sexual response .

Figure 2 shows the proposal matrix of SRH in women with T1DM (Figure 2).

Table 2 shows how to create subcategories and categories related to the concept of SRH of women with T1DM based on the codes extracted from selected articles.

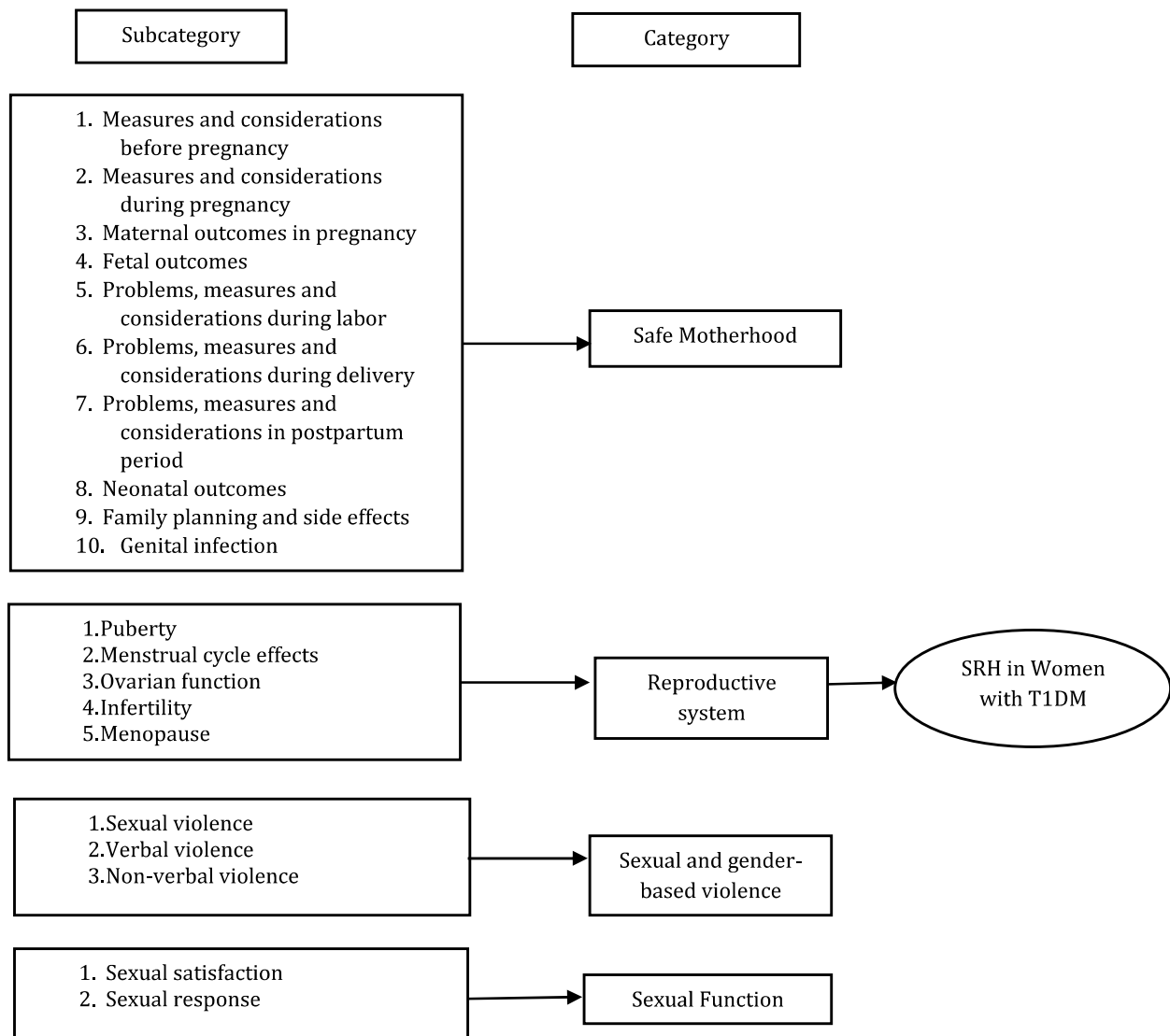
As shown in Table 2, we did not find any articles that had exclusively examined the dimension of sexual and gender-based violence and AIDS in women with T1DM. Nonetheless, these dimensions were included in the design of the proposal matrix because the concept of SRH in women with T1DM was developed in this study based on the definitions provided by the WHO and UNFPA, and because sexual violence and gender-based violence are regarded as integral dimensions of the concept of SRH in women. In addition, the category of safe motherhood was modified and developed according to the existing theoretical framework,

and the category of reproductive system was added to the initial dimensions.

Safe motherhood in women with T1DM ,based on the results, this category was developed in comparison with the existing definitions and categories and(12, 13) the subcategories were modified and expanded. The category of safe motherhood in women with T1DM included the specific subcategories of measures and considerations before pregnancy;

measures and considerations during pregnancy; maternal outcomes in pregnancy; fetal outcomes; problems, measures and considerations during labor; problems, measures and considerations during delivery; problems, measures and considerations in the postpartum period; neonatal outcomes; family planning and side effects, and genital infection. The impact of diabetes on these subcategories was examined in this study.

Figure 2. The proposed matrix of the concept of SRH in women with T1DM



Based on the results of this study, measures such as examining BS (24, 25) and lipid levels (26), insulin dose adjustment (27), HbA1c levels every 4-8 weeks (28-30), history of vaccination (31), and the heart and eyes evaluation (28) are necessary in women with T1DM who are planning to become pregnant. Controlling maternal weight at appropriate intervals to identify abnormal weight changes (24) should be performed in an integrated manner and with the cooperation of a medical team to reduce maternal and fetal complications due to T1DM in pregnancy. Furthermore, eye health along with thyroid (28) and kidney (32, 33) functions should be controlled by a specialist in mothers with T1DM in each trimester of pregnancy. Necessary measures to assess fetal health

include ultrasound in the 28th week of pregnancy to examine fetal growth (27, 34) and Doppler ultrasound in the 28th week of pregnancy to evaluate fetal growth and placental function are crucial in addition to the common care measures adopted in a normal pregnancy (34). Furthermore, screening for Epstein anomalies and, if required, amniocentesis, are also mandatory (28). The low rate of preconception counseling in diseases such as T1DM can be due to people's lack of awareness about the importance of these services (35).

According to this study, metabolic disorders and emergency CS are the most important problems during labor for women with T1DM (36).

Table 2. The Codes, subcategories and categories related to the concept of SRH in women with T1DM

Code	Subcategory	Category	Concept
Adjust insulin dose (27) Hemoglobin A1c status (HbA1c) evaluation , pneumococcal and influenza vaccine (31) BS and cholesterol evaluation (26) Pre-conception counseling (37) The eyes, kidneys and heart evaluation (25) Tight glycemic control (TGC)(38) Ultrasound at gestational ages of 18-22 and 28 weeks (to evaluate fetal anomaly/fetal growth and umbilical cord doppler) (34) and cardiac anomaly screening (31, 39) Amniocentesis (28)	Measures and considerations before pregnancy	Safe Motherhood	SRH in Women with T1DM
Controlling HbA1c every 4-8 weeks, Evaluation of the kidneys, eyes (25) and thyroid in each trimester of pregnancy ,Mother's BS and weight gain evaluation(28) Developing a food plan (40) Non stress testing (NST) once or twice per week through gestational age of 32-34 weeks (41) BP (40) Kidney dysfunction (42) Preeclampsia (43) pregnancy induced hypertension(42) Increased body mass index (BMI) (44) Increased HbA1c (45) Diabetic ketosis (45) Low maternal weight gain (46) Seizure (43) Death (45) BS disorder and increased need for insulin (47) Abortion (46) Intrauterine fetal death (42) Polyhydramnios (34) Congenital malformations (42) Low birth weight (42) Macrosomia (48)			
	Measures and considerations during pregnancy		
	Maternal outcomes in pregnancy		
	Fetal outcomes		

Code	Subcategory	Category	Concept
Intrauterine growth restriction (IUGR) (49) BS disorder (45) Emergency CS (44) Prolonged labor (38) Premature rupture of membranes (50) Adjusting the BS between 70 and 110 mg/dl during labor (51) Administration of isotonic intravenous fluids (38) Paying attention to the symptoms of ketosis (52) Changing insulin injection method (53)and insulin amount (52) Dystocia (54)	Problems, measures and considerations during labor		
Postpartum hemorrhage (50) BS disorder(36) TGC (41, 55) Low-doses of rapid-acting or fast-acting insulin (41) Adjusting insulin dose (53) CS infection (56) Urinary tract infections (43) Vision problem (43) Opening the CS incision (57) Death (42) Breastfeeding less than 6 months (58) Assessment of the eyes (28) and the thyroid 4 to 8 weeks after delivery (33) Choosing a safe and effective method of contraception 6-8 weeks after delivery(25) Recommended breastfeeding (34) Low birth weight (LBW) (42) Preterm labor(45) Hospitalization in the neonatal intensive care unit (NICU) (59) Macrosomia (60) Abnormality (60) Hypoglycemia (61) Complications of shoulder dystocia (62) Jaundice (41) Low appearance, pulse, grimace, activity, and respiration score (APGAR) (63) Respiratory distress syndrome (RDS) (45) Death (63) IUGR (64) Feeding problems (65) Family planning consulting (66) Copper intrauterine device (IUD)(64) The combined oral contraceptive pill (COCP) (67) Progesterone ampule (68) Tubal ligation (69) Mirena (68) Progestogen-only pill (POP) (68) Barrier methods (68) Hypercholesterolemia/increased HbA1c Hyperglycemia (70) Coagulopathy (64) Thrombosis (71) Human papilloma virus (72) Trichomonas and Candida vaginalism (73) HIV (12, 13) Herpes (74) Late menarche (73)	Problems, measures and considerations during delivery		
	Problems, measures and considerations in postpartum period		
	Neonatal outcomes		
	Family planning and side effects		
	Genital infection		
	Puberty	Reproductive	

Code	Subcategory	Category	Concept
Late pubarche (73)		system	
Late thelarche (73)			
Oligomenorrhea (75)			
Menorrhagia/Hypermenorrhea (76)			
Hyperglycemia in the luteal phase (24)	Menstrual cycle effects		
Menstrual irregularities (75)			
Amenorrhea (76)			
Hyperandrogenism, ovarian enlargement (77)			
PCOS(32)	Ovarian function		
Premature ovarian failure (POF) (78)			
Primary Infertility (79)	infertility		
Secondary Infertility (79)			
Premature menopause (before the age of 40 years) (78) (80)	Menopause		
Early menopause(before the age of 45) (81)			
History of coercion to coitus by husband(15)	Sexual violence	Sexual and gender-based violence	
History of coercion to coitus by other (15)			
history of sexual violence by husband (15)	Verbal violence		
history of sexual violence by parent (15)			
history of beatings by husband (15)	Non-verbal violence		
history of beatings by parent (15)			
Decreased sexual satisfaction (82, 83)	Sexual satisfaction		
Decreased marital interests (84)			
Decreased Sexual intimacy (85)			
Vaginal dryness (86)			
Decreased clitoral erection (86)		Sexual Function	
Decreased libido(87)			
Decreased sexual excitement (88)	Sexual response		
Decreased vaginal lubrication (87)			
Decreased orgasm (89)			
Dyspareunia (82)			

During the labor phase, BS levels decrease, resulting in lower insulin requirements in women with T1DM; therefore, to prevent hypoglycemia and ketosis, the control of BS levels and the use of injectable glucose, if necessary, are recommended during labor (41). Encouraging such mothers to breastfeed is also helpful because breastfeeding the infant can help reduce the incidence of hypoglycemia (90), although the period of breastfeeding is usually shorter in mothers with T1DM than that in healthy mothers for reasons such as undergoing CS, preterm delivery, concern for glycemic status, hospitalized in NICU, the young age of the mother and her lack of adequate training (91). The likelihood of postpartum wound infection, interventions after CS (56) and vulvovaginitis increases in T1DM, themselves requiring the control of BS and further health considerations (62).

The risk of congenital anomalies, fetal macrosomia, LBW (30), polyhydramnios, fetal death (62), shoulder dystocia, abortion (92), neonatal hypoglycemia at birth, RDS and perinatal death increases significantly in mothers with T1DM compared to the healthy population (36). Preterm labor can be 4-8 times more likely in women with T1DM than that in healthy individuals (93).

Awareness and use of family planning methods before conception and achieving optimal BS are some of the effective measures to reduce the adverse consequences of pregnancy (25). Due to the adverse effects of contraceptive methods on BS levels and insulin function, family planning counseling is important for people with T1DM (66). COCP administration and depot medroxyprogesterone acetate injection can increase BS and lipid levels in some individuals with diabetes. Norplant has the least metabolic effects in this group (70). The possibility of thromboembolism increases

in women with diabetes consuming estrogen (94). If there is no evidence of retinopathy, nephropathy, cardiovascular or microvascular complications, combined pills are considered safe methods (95).

The progestogen-only pill (POP) is regarded a safe option for women with diabetes of any age with or without complications (96). Medroxyprogesterone acetate and norethindrone enanthate are suitable for women with diabetes without complications such as overweight, micro- and macro-vasculopathies, and BS disorders (97). Copper IUD is a safe and suitable method for women with T1DM (98). Diabetes predisposes women to bacterial and fungal infections, most of which are candida albicans (99). The frequency of these infections is directly related to glucose control status and HbA1c levels (100).

In the present study, the category of reproductive system in women with T1DM includes the five subcategories of puberty, menstrual cycle effects, ovarian function, infertility and menopause. If the BS level is not properly controlled in T1DM, the toxic effects of hyperglycemia will impair gonadal function (101). High BS and insulin deficiency, which occur in T1DM, cause disturbances in the signaling pathways of the hypothalamic-pituitary-ovarian axis (HPO) and lead to disorders of the reproductive system (102).

The lack of insulin is effective in inhibiting gonadotropin hormones, which can itself cause delayed puberty. Also, the presence of autoantibodies is one of the causes of delayed puberty in T1DM (103) also 20%-40% of these women experience menstrual disorders in the form of secondary amenorrhea and oligomenorrhea (104). In addition, high levels of anti-müllerian hormone (AMH) in childhood, increased free androgen in the bloodstream, overweight and obesity, and disorders of the HPO axis are regarded as predisposing factors for PCOS in T1DM. Chronic hyperglycemia has toxic effects on ovarian germ cells and causes premature menopause by interfering with follicle maturation and increasing the rate of cellular apoptosis (7).

According to the results of this study, the sexual dimension was composed of the subcategories of sexual satisfaction and sexual

response in women with T1DM. According to this study, T1DM could have a significantly negative impact on female sexual function (105) and sexual functioning is an important, though sometimes ignored, component of human well-being (106).

So existing general dimensions of the concept of women's SRH include safe motherhood, family planning, STD, HIV/AIDS, sexual history, and sexual and GBV and newly emerged and specific dimensions of the concept of SRH in women with T1DM based on this study include safe motherhood, reproductive system, sexual and gender-based violence, and sexual function. These dimensions are specifically defined by considering the effects of T1DM on the functions of the sexual and reproductive system and specific considerations related to these dimensions.

Discussion

According to this study, the concept of SRH in women with T1DM consists of 4 subcategories (safe motherhood, reproductive system, sexual and gender-based violence, and sexual function.) and 20 subcategories. These categories share some common points with the international definitions while some specific attributes result from the impact of T1DM on the concept of SRH and its components. The innovative finding of this study is that we clearly categorized and identified the dimensions that should be considered in providing comprehensive SRH services for women with T1DM with an extensive review of existing studies.

Safe motherhood is considered a subset of the concept of SRH and includes actions taken toward women's health, family planning, and pregnancy, delivery and postpartum safety with the aim of achieving optimal health for the mother, fetus and infant during pregnancy, delivery and postpartum. Safe motherhood is accomplished through the delivery of proper healthcare services by skilled personnel before and during pregnancy and after delivery, taking essential actions for controlling life-threatening childbirth complications, preventing and managing the complications of unsafe abortions, planning for a safe pregnancy and delivery of family planning services (107).

Women with T1DM planning their pregnancy should be carefully monitored from the very beginning in the preconception period in specialized multidisciplinary clinics including an endocrinologist, primatologist, nutritionist and diabetes educator, when available (108).

Preconception counseling should be aimed to achieve BS levels as close to normal as safely possible and HbA1c <6.5% to reduce the risk of congenital anomalies, preeclampsia, macrosomia (108), the incidence of small for gestational age, preterm delivery, and admission to NICU (109).

Women with T1DM should receive the following measures at prenatal visits: nutrition counseling for setting meals and achieving optimal BS levels (110), exercise (at least 30 minutes per day) (41), dental disease assessment (111), screening for psychosocial and emotional disorders (112), fasting lipid profile, BS, HbA1c, liver function tests (113), and screening for other autoimmune diseases (such as thyroiditis and celiac disease) (114).

Based on available data, pre-prandial self-monitoring of BS was deemphasized in the management of diabetes in pregnancy (113). T1DM is associated with a 15%–20% incidence of pre-eclampsia (115), therefore, calcium supplementation intake from gestational age of 12 weeks, aspirin 100–150 mg daily during gestational age of 12-36 weeks, and checking BP and urinalysis at each visit are recommended to prevent preeclampsia (116). In addition to routine pregnancy ultrasounds, most medical centers recommend NST once or twice per week from 32–34 weeks for women with T1DM (117) and serial fetal growth scans every 2–4 weeks from gestational age of 28 weeks (116).

For pregnant women with T1DM, there is a risk of fluctuations in BS levels, increased need for insulin (47) and increased levels of HbA1c (45), which can lead to diabetic ketosis and negative maternal and fetal outcomes (118). The risk of kidney dysfunction (42), preeclampsia (44) and pregnancy-related hypertension (119) is high among these mothers, resulting in increased maternal death in them as compared to the healthy population (120).

Controlling the state of diabetes during labor plays a significant role in the health of the baby and the prevention of hypoglycemia. Using

short-acting insulin can reduce the risk of sudden hypoglycemia in the infant (121). During the latent phase of labor, the mother's metabolic needs are usually stable, while her metabolic needs increase and the need for insulin decreases during active labor. In patients with chronic diabetes, insulin decreases suddenly, which requires careful monitoring (91). Therefore, the amount, type and method of insulin intake and the mother's diet meant to prevent hypoglycemia should be carefully controlled (45).

During labor, the need for insulin decreases due to increased maternal metabolism. It is necessary to carefully control BS and fluid intake to prevent maternal and fetal hypoglycemia and ketosis and reduce the excess infant oxygen need that high glucose supplies demand (122).

The timing and method of childbirth should be planned based on all aspects of maternal and fetal health. When normal vaginal delivery is planned, labor is often induced at 38–40 weeks to prevent serious late adverse outcomes for mothers and fetuses (such as stillbirth, macrosomia and pre-eclampsia) (41, 117). If oxytocin induction is administered during labor, the dose of pre-breakfast rapid-acting insulin should be reduced in addition to a reduction of 30%–50% in the moderate and long-term insulin dose (116). Elective CS is recommended if the estimated fetal weight at delivery is >4500 g (to prevent shoulder dystocia) (123).

Encouraging such mothers to breastfeed is also helpful because breastfeeding the infant can help reduce the incidence of hypoglycemia (90), although the period of breastfeeding is usually shorter in mothers with T1DM than that in healthy mothers for reasons such as undergoing CS, preterm delivery, concern for glycemic status, hospitalized in NICU, the young age of the mother and her lack of adequate training (91). The likelihood of postpartum wound infection, interventions after CS (56) and vulvovaginitis increases in T1DM, themselves requiring the control of BS and further health considerations (62).

Immediately after delivery, as insulin resistance decreases, the need for insulin decreases and usually returns to pre-pregnancy levels within 2 to 6 weeks, which should be

considered in regulating the metabolic status of mothers (124). During breastfeeding, women with T1DM need approximately 10% less insulin compared to before pregnancy, with wide individual variations (117). In the first 6 months, HbA1c level is lower in the breastfeeding women with T1DM compared to non-lactating women (125). In the post-partum period counseling about BS status, healthy lifestyle and eating, physical activity is necessary, which should be adjusted according to the specific conditions of each person(116).

There is a relationship between HbA1c levels and adverse fetal outcomes (126), such that controlling BS and bringing HbA1c to less than 7% before conception decreases perinatal interventions significantly for the fetus (127).

Receiving specialized counseling before and during pregnancy from the medical (110), using a safe and effective contraception method for a planned pregnancy (128), exercise (129), following a proper diet (130), strict control of BS and HbA1c before and during pregnancy (95) adjusting the type and dose of insulin(131), paying attention to the symptoms of hyperglycemia and ketosis(128), following the medication instructions, paying attention to the possible symptoms of preeclampsia (128), performing fetal health assessment tests on time (132), and targeted ultrasounds for fetal health can improve maternal, fetal and neonatal outcomes of T1DM (133). According to WHO guidelines, the benefits of using emergency contraceptive methods outweigh the risks, even in cases of severe vascular disease (134). Tubal ligation in women with T1DM should be performed with strict control of BS and attention to possible postoperative infection (98).

Control of BS and HbA1c, personal hygiene, careful selection of broad-spectrum antibiotics (to prevent the disruption of the normal vaginal flora) and attention to the effect of oral sex in increasing the risk of genital infections (such as candidiasis) can reduce the risk of vaginal infections (especially fungal infections) in women with T1DM (135).

Awareness of reproductive health is considered an important dimension that should be integrated into the available SRH programs. Puberty, menstruation, pregnancy, lactation, and

menopause are important topics related to the female reproductive system that should be incorporated into educational programs aimed at raising awareness in women, as they can help diagnose reproductive and sexual problems (136). The Center for Disease Control and Prevention considers PCOS, STD, gynecological cancers, AIDS and HIV and sexual violence examples of common concerns and problems related to the health of the female reproductive system (137).

Disorders in gonadotropin-releasing hormone pulses affect the amplitude and level of luteinizing hormone (LH) secretion and can lead to amenorrhea(138). Hyperglycemia has a toxic effect on the hypothalamic nerve cells and can cause hypothalamic cell death in the long term(139).

Chronic high BS and the lack of insulin secretion in T1DM have a toxic effect on hypothalamic cells, resulting in decreased levels of LH and follicle-stimulating hormones (FSH), which can lead to ovarian hypogonadism, decreased estrogen levels, ovarian insufficiency and delayed puberty (7). In addition, high levels of anti-müllerian hormone (AMH) in childhood, increased free androgen in the bloodstream, overweight and obesity, and disorders of the HPO axis are regarded as predisposing factors for PCOS in T1DM (7).

In these women, antibody-induced chronic oophoritis, base level of AMH and toxic effects of hyperghasemia in related to early menopause (140).

Sexual health is considered a part of reproductive health that is discussed as a need and strategy for achieving the Millennium Development Goals (141). The WHO defines couples' sexual health as having a positive and respectful approach in sexual relations along with pleasant and safe sexual experiences without coercion, discrimination, and violence. Sexual health issues include a wide range of sexual orientations and gender identities, sexual expressions, and pleasurable relationships and also include negative consequences such as reproductive system infections and infertility, HIV, unwanted pregnancy and its unsafe abortion, sexual disorders, sexual violence, and harmful acts such as female genital mutilation (142).

Diabetes is associated with tissue hypotrophy and sensitivity impairment due to the synergetic effects of vasculopathy and neuropathy. Some studies have suggested a positive association between clitoral vascular resistance and the metabolic syndrome and decreased sexual arousal, body image concerns, and increased somatization anxiety symptoms (143). Early onset and diagnosis of T1DM, patients should anticipate the negative impact of the disease on their sexual function in future (144).

The sexual function of the patient is affected by changes in blood flow, increased incidence of vaginal infections, and decreased vaginal wetness (145). The sexual response cycle of women with T1DM is affected by chronic hyperglycemia (146) and about one-third of women with T1DM have sexual problems, mostly in the form of sexual dysfunction, orgasm dysfunction, and decreased vaginal wetness (147). Thus, the level of sexual satisfaction in women with T1DM decreases due to the vascular and neurological consequences of diabetes (148, 149).

Consultation with physicians and trained individuals who have sufficient skills and experience in sexual disorders (150), as well as the use of medications, vaginal lubricants and devices (for clitoral engorgement, for instance) can be effective in identifying and resolving common sexual problems in women with T1DM (151).

Due to the extent of the concept of SRH in women with T1DM and its components the review on literature was performed, and led to a significant increase in the number of keywords and their synonyms for searches in selected databases, which yielded a high volume of articles before they could be screened and selected. In addition, only Persian and English articles that could be accessed in full were examined.

Conclusion

In this study, the concept and dimensions of SRH in women with T1DM were developed based on the existing evidence and according to the effects of T1DM on SRH. It could be a basis for designing programs to promote SRH in women with T1DM according to the specific dimensions of SRH in these women. Additionally, following designing the analysis

matrix of the concept and developing its categories and subcategories, a specific questionnaire could be designed and validated for assessing SRH in women with T1DM. The administration of such a questionnaire can then facilitate effective planning and adopting the necessary measures to promote SRH in women with T1DM.

Acknowledgements

The authors would like to express their gratitude to the Deputy for Research and Technology at the school of Nursing and Midwifery, Shahid Beheshti University, Tehran< Iran. The present article is part of the Nasrin Azimi Ph.D thesis in reproductive health of Shahid Beheshti University of Medical Sciences (under ethical code of: IR.SBMU.PHARMACY.REC.1399.218).

Conflicts of interest

Authors declared no conflicts of interest.

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